CompuPro®

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CP/M-86®

Technical Manual
& Installation Procedures

SINGLE USER 16-BIT OPERATING SYSTEM

CP/M-86 TECHNICAL MANUAL
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CP/M-86 USER GUIDE

INTRODUCTION

There are two diskettes included with your CP/M-86 1.1 system. Diskette number 1 contains a bootable CP/M-86 system for operation with the **DISK** 1 floppy disk controller and the **CPU 8085/88**, and a number of ".SYS" files which will be described later. Diskette number 2 contains a bootable CP/M-86 system for operation with the **DISK** 1 floppy disk controller and the CPU 86/87, and all of the system command files, utility programs and BIOS source files. This document will describe how to get CP/M-86 "up and running" with a minimum amount of trouble.

The enclosed version of CP/M-86 requires the following hardware for proper operation:

HARDWARE REQUIREMENTS

(1) An operational S-100 mainframe.

(2) A CompuPro CPU 8085/88 (with swap port at OFDh) or CPU 86/87

(3) A CompuPro SYSTEM SUPPORT 1 with the GO86 EPROM installed in socket U16 and addressed at location OFF000H, and the serial channel with the I/O block addressed at 50H.

   You could also use an INTERFACER 3 or 4 addressed at 10h or an INTERFACER 1 or 2 addressed at 0 as your console.

(4) A CompuPro DISK 1 floppy controller addressed at OC0H and J17 jumpered for your processor.

(5) At least 64K of 24 bit address RAM in the first 64K page.

(6) An operational disk drive subsystem.

MAKING A BACKUP SYSTEM

The first thing that must be done when trying to bring up and configure your CP/M-86 system is to make two backup copies for alteration. This will require four diskettes formatted in double density with 1024 byte sectors.

To format the four blank diskettes, boot up the appropriate CP/M-86 diskette and call up the format utility by typing: **FORMAT(cr).** Insert a blank diskette into the B drive. Select the B drive for formatting and 1024 byte sectors. When the format is done, repeat for the rest of the diskettes.

To copy the system disk onto the formatted diskettes, type: **COPY(cr)** with the blank formatted diskette in the B drive and the system master in the A drive. Choose the source on A and the destination on B. The COPY utility will then copy the master disk track-for-track. Repeat with the second blank diskette. Then change masters and copy the second master.

The foregoing method will leave the copies in the same format (1024 byte sectors) as the master. If you wish to change densities to 256 or 512 byte sectors, or if you want to modify the loader, you will have to use the SYSGEN88 utility for the CPU 8085/88 or the SYSGEN86 utility for the CPU 86/87. If you are familiar with CP/M 80, the SYSGEN.CMD utilities are almost the same as SYSGEN.COM. To use the SYSGEN utilities, put your CP/M-86 diskette in the A drive and a formatted diskette in the B drive. Invoke the SYSGEN utility by typing: **SYSGEN88(or SYSGEN86) LOADER.CMD(cr).** Then select the destination drive to be "B". Repeat for as many diskettes as necessary. Then you may PIP as many files as necessary onto the copies. NOTE: PIP the file CPM.SYS file first to minimize boot time.

Keep in mind that there are two different SYSGEN programs. The one on disk number one is for the CPU 8085/88 processor and is called SYSGEN88.CMD and the one on disk number 2 is for the CPU 86/87 processor and called SYSGEN86.CMD. Be sure to use the one that is for your processor.

NOTE: SYSGEN88.CMD and SYSGEN86.CMD are our versions of the file called LDCOPY.CMD in the Digital Research documentation, and they perform the same function.

FORMATTING THE HARD DISK - DISK 2

If you have a hard disk or disks, you must run the DISK 2 formatter/diagnostic. The DISK 2 program is included on your CP/M diskette number 2. It should be run as follows:

        A>disk2 [drive type] all

and press the RETURN ([RET]) key. The "drive type" is either M10 or M20, depending upon whether your hard disk holds 10 or 20 megabytes. This test takes two hours to complete. It begins by formatting the tracks, which is evidenced by the following display:

Formatting Track : NNN   Hard NNN   Soft NNN

The track number (NNN) and number (NNN) of hard and soft sector errors are displayed to the right of each entry. If an excessive amount of errors are reported, consult the Disk 2 Technical Manual.

The test continues with:

Verifying Track

Data Test Track

and ends with:

Seek Test

There are 12 "passes" through the sectors in this last test. Upon completion, a bad sector report is given. Any bad sectors found are "mapped out" or effectively blocked from use.

CONFIGURING THE CP/M-86 SYSTEM

There are many different ways a CP/M system can be configured to use combinations of hard and floppy disks. You must decide whether you want the "A" drive to be on the hard disk or on the floppy disk, if you are going to use an M10(10 megabyte) or M20 (20 megabyte) hard disk, and which interfacer board you want for the console. Configuring a BIOS for your system could be done by setting equates in the BIOS source, assembling it with Sorcim's ACT-86 assembler, and overlaying a new BIOS. However, this is fairly involved process and not everyone has the ACT-86 assembler. So we have configured almost every possible configuration for you and put them on your master disk number 1 in the form "CPM??XXX.SYS", where the "??" represents revision number, and the "XXX" represents a possible configuration as shown in the chart below. After you have formatted the Winchester drive to be used with your system you must install the desired version of CP/M. With CP/M-86 this is quite easy since the system is read in to memory from a file on the disk called "CPM.SYS".

KEY

```
CPMMA___
      ^^^                                    /  A - ALL
   |||                                      /  B - BIT BANGER (not supported)
   |||---------- CONSOLE I/O - <    S - SYSTEM SUPPORT 1
   ||                                  \  1 - INTERFACER 1 OR 2
   ||                                  \  3 - INTERFACER 3 OR 4
   ||
   ||                           / H - HARD DISK DRIVE A
   ||---------- BOOT FROM - <
   |                            \ F - FLOPPY DISK DRIVE A
   |
   |                            / 1 - 10 M BYTES
   |---------- HARD DISK SIZE - <
                                \ 2 - 20 M BYTES
```

Once you have determined the above three variables, look for the appropriate CP/M system file on the master distribution diskette by using the directory command DIR CPM??XXX.SYS where the x's represent the above variables. A response should follow which will have the floppy and hard disk BIOS revision numbers where the question numbers were. Then the desired system can be generated using the "PIP" command as shown below.

        EXAMPLE: PIP CPM.SYS=CPMKD1H3.SYS

This will create a CP/M system which will boot off a 10 M byte hard disk drive with the console I/O on the INTERFACER 3 or 4 (user 7). The printer is on user 6.

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The final step is to make a system disk with your "CPM.SYS" file and all of the system commands on it. This should be done with "SYSGEN88" or "SYSGEN86 and "PIP" as described above.

Currently, although the "A" drive can be on the hard disk, the system still must boot up off the floppy drive. After the system is up and running, the "boot" floppy can be removed, since CP/M-86 does not go to the disk on a warm boot.

USING CP/M-86 IN DIFFERENT MEMORY SIZES

Unlike CP/M 80, which needs to be reassembled (or MOVCPMed) every time you want to change the memory size, CP/M-86 determines how much memory it can use by a table called MRT for Memory Region Table. The MRT and its function is described in your CP/M-86 documentation. The CompuPro implementation of CP/M-86 will "self-size" the system every time it boots up and fill in the MRT table accordingly. The end of memory is found by reading the data right above the system, changing that location, and reading it again. If the location was changed, a location 16 bytes higher is tried. This is repeated until a location is found that cannot be changed, (no memory or ROM). So you can add any increment of memory, by just putting it in the system and booting it up!! The system will immediately know about it!

The system sign on message should tell you how much memory was found. If this number does not agree with the amount of memory in your system, you should check the switch settings on the memory boards.

Note that due to the self-sizing feature of CompuPro's CP/M-86 1.1, it will not boot up in "global" memory (memory that does not respond to all 24 IEEE 696 address lines).

As shipped, CP/M-86 is configured with drive "A" as the first floppy drive and there is no hard disk, the memory drive is drive M. The console I/O can be either a serial port on an INTERFACER 1, 2, 3, 4 or the serial port on the SYSTEM SUPPORT 1. The list device is configured for a serial INTERFACER 1 or 2 or relative user 4 on an INTERFACER 3 or 4. Note that the "Bit Banger" serial port on the Disk 1 is not implemented.

USING THE COMPUPRO M-DRIVE/H MEMORY DISK

The CompuPro CP/M-86 BIOS includes drivers for an M-DRIVE/H memory disk, containing up to <u>4</u> <u>megabytes</u> of fast memory disk on drive "M".

The CompuPro CP/M-86 BIOS will automatically determine how many M-DRIVE/H boards are present, if any, and set the disk parameter blocks accordingly. The sizing routine is exactly like the memory sizing, and no data is destroyed at boot. The system sign on will tell you how big a memory drive it found. If that number does not

equal 512 times the number of M-DRIVE/H boards in your system, you should check your switch settings.

Once the system is booted up, the MFORM program is automatically invoked to format the memory drive. So you can just copy any files that you want to access very <u>fast</u> onto drive "M" with a "SUBMIT" file or with "PIP" and get ready to fly!

SOFTWARE SECTION

INTRODUCTION

The purpose of this section is to describe the software supplied with CP/M 86 1.1 and the CompuPro DISK 1 Floppy Disk Controller for the Standard IEEE 696 (S-100) bus.

This manual is written for purchasers who are familiar with the CP/M BIOS customizing techniques. If CP/M-86 1.1 was purchased with the Disk 1 controller then all corrective patches have been installed. On the other hand, if the CP/M was purchased for a different controller then be sure to obtain and install all CP/M corrective patches.

The information contained within this document is divided as follows:

    a. Software User's Guide
    b. Software Features
    c. Software Internal Design
    d. CBIOS Customization Guide

The Software User's Guide describes how to use these software packages:

    a. FORMAT.cmd --disk formatter
    b. COPY.cmd -- disk copy utility
    c. SYSGEN88.cmd / SYSGEN86.cmd -- system track copy utility
    d. DISK2.cmd -- hard disk formatter
    e. MFORM.cmd -- memory disk formatter

The next section describes the external features of the supplied software. This section describes the enhancements and assumptions made by the CompuPro CBIOS routines and utility routines.

The Software Internal Design section describes the design of the supplied software. This section should help the user understand how the software components work; thus enabling the purchaser to modify the software for his hardware configuration.

APPLICABLE DOCUMENTS The reader should be familiar with the following documents.

    a. NEC uPD765 Floppy Disk Controller Application Note
    b. INS2651 Programmable Communications Interface Note
    c. CompuPro DISK 1 Floppy Disk Controller Description
    d. An Introduction to CP/M Features and Facilities
    e. CP/M-86 Operating System Users Guide
    f. CP/M-86 Operating System System Guide
    g. CP/M-86 Operating System Programmers Guide

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The following paragraphs describe the operating features of the supplied utility programs.

FORMAT.cmd — Floppy Disk Format Utility

The FORMAT.cmd utility program is supplied so that purchasers of the Disk 1 board can change the density of his disk (data is destroyed). The FORMAT.cmd utility formats floppy disk in IBM compatible formats; not all disk controllers are IBM compatible.

The FORMAT utility contains the Disk 1 board interface routines allowing the user to run under a current IEEE 696 CP/M system.

The FORMAT utility has simple and straightforward operating instructions. The user is prompted for input as needed to control the utilities flow. The user initiates the FORMAT utility by entering the following:

    FORMAT

    or

    FORMAT drive

If the drive is not specified on the command line then the FORMAT utility prompts the user with the following line:

    Specify drive (A: - D:) :

The user now enters the drive (A thru D) and the FORMAT utility proceeds.

After the user has specified the drive to be formatted, FORMAT attempts to determine the specified disks format. The disk format or lack thereof is displayed for the user and a message requesting the new format selection is displayed. The format of these displays are as follows:

    Disk is Formatted as 1024 byte sectors.

    Select Disk format mode (0,1,2,3):
         0 = 128   2 = 512
         1 = 256   3 = 1024   > _

The user now enters the disk formatting selection and the FORMAT utility begins formatting the disk. As each track is formatted an F appears on the screen (total of 77). After formatting all the tracks the FORMAT utility begins a verify operation. This verify

operation informs the user of possible bad spots on the floppy
disk. These displays and a description of the output follows:

Confirm ready for format on disk drive B (y)._

```
          1         2              6         7
0123456789012345678 90   . . .   012345678901234567
FFFFFFFFFFFFFFFFFFFF     . . .   FFFFFFFFFFFFFFFFFF
VVVVVVSSSVVVVEEEVVVV     . . .   VVVVVVVVVSVVSVVEEE
```

Symbol meaning: F -- successful format operation.
                     V -- read verified.
                     S -- error occurred but retry worked.
                     E -- hard failure.

After the verification, the FORMAT utility asks the user if another
disk is to be formatted. The user response will result in one of
three actions as follows:

1. Return to CP/M
2. Formatting another disk with the same parameters.
3. Change formatting parameters.

The FORMAT utility uses a lot of user interactions to control the
utilities flow. The user can get a general idea of the inputs
required by entering the following command line:

FORMAT ?

This will result in the following display:

FORMAT will format a diskette to be used with
the CompuPro disk subsystem.

The FORMAT program is initiated by:

FORMAT <dr:><cr>

Where <cr> is the Carriage Return.
If the drive <dr:> is not specified,
it will be prompted for.

COPY.cmd — Disk Copy Utilities

The COPY.cmd utility program performs diskette copy functions.

This program is intended to be used to copy an entire diskette to
another diskette. It performs this by reading in a track of data,
writing it out, reading it back in and comparing.

The user must tell this program the following information:

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1. Area of diskette to be copied.
2. Source drive.
3. Destination drive.

These programs get this information by prompting the user with the following messages:

        CompuPro COPY Utility Version 2.X.

        Do you want to copy:

                SYSTEM tracks only?   (type S)
                DATA tracks only?   (type D)
                ALL of the disk?   (type A)
                Exit back to system?   (type X) _

        Source drive? (A, B, C, or D) _
        Destination drive? (A, B, C, or D) _

        Put source disk on X
        Put destination disk on Y
        Then type <return>

As with the FORMAT program the following is available:

        COPY ?

This will result in the following display:

        Copy will copy disks on the CompuPro
        disk subsystem. To start, type:

                COPY <portion><cr>

        Where <cr> is Carriage Return
        and <portion> is S = system, D = data or
        A = all. If not entered, a prompting message
        will appear.

        The source and destination drive prompts display.

A similar message will be displayed by the CONVERT program.

SYSGEN88.cmd / SYSGEN86.cmd — System Tracks Copy Utility

The SYSGEN88 and SYSGEN86 programs are used to put the BOOT and LOADER routines on the system tracks (0 and 1) of a disk drive formatted in any of the MFM modes. SYSGEN88 will put a BOOT program on track 0 that is written in 8080 code. The BOOT 8080 routine switches over to the 8088 processor of the CPU 8085/88 board before beginning execution of the LOADER. SYSGEN86 will put a BOOT program on track 0 that is written in 8086 code for the CPU 86/87 processor. The BOOT routines are built into the SYSGEN utilities.

The SYSGEN88 and SYSGEN86 programs must be given a source LOADER file as part of the command line as shown below:

```
SYSGEN88 LOADER.CMD
COPYSYS Version 2.2x
Destination drive name (or return to terminate). B
```

The user now enters a drive name. The program will put the BOOT 8080 routine and the LOADER file on the system tracks (0 and 1) of the "B" drive. The SYSGEN utilities will continue to ask for a destination drive until only a return is pressed.

The "CPM.SYS" file should now be "PIP"ed over to the "B" drive. "PIP"ing the "CPM.SYS" file first will minimize the time required to boot the system.

DISK2.cmd — Hard Disk Format/Test Utility.

Before using your hard disk, you must format it with the "DISK 2" utility provided with your CP/M 80 and CP/M-86 system disks. The "DISK 2" program will format, verify and test your hard disk drive. The different options that can be used are listed below.

Usage: DISK 2 {options}

At least one option must be specified such as the drive type. You can mix any of the options.

Options consist of:

```
m10           Set drive type to Fujitsu 10 Mbyte
m20           Set drive type to Fujitsu 20 Mbyte
m26           Set drive type to Shugart 26 Mbyte*
m10m          Set drive type to Memorex 10 Mbyte*
drive #       Format selected drive
format        Format headers
data          Write out data fields with E5H
test          Perform a data field test
seek          Perform a seek test
all           Perform format, data test, seek test
skew #        Set skewing of disk to specified number
              This option goes along with hardware settings.
```

* Although the DISK 2 program will format these drives, The CompuPro CP/M 80 and CP/M-86 systems are not configured for them.

Defaults:

If an option is not specified then the following defaults are used:

```
M20
skew of 2
sector size 1024
drive 0
no tests or formatting
```

Examples:

```
disk2 format data
disk2 m20 all
disk2 data
disk2 format data drive 1 skew 3 m10
```

MFORM.cmd - Memory Disk Format Utility

The MFORM program will format any size CompuPro M-DRIVE/H memory disk, using a format compatible with all of the CompuPro CP/M M-DRIVE/H implementations. This means that you can transfer files between CP/M 2.2 and CP/M-86 by putting files on the M-DRIVE/H memory disk.

The CompuPro BIOS uses the auto-vector feature of CP/M to invoke MFORM at cold boot. If the MFORM program sees that a memory drive has already been formated, it <u>will</u> <u>not</u> reformat the memory disk. Thus data on the memory disk is <u>not</u> destroyed when reset is pushed.

You can force a reformat of the memory drive by typing

    A>MFORM M

The program will prompt you and ask if you really want to proceed and destroy all the data.

Once the memory disk is formatted, you can use it just like any other disk drive.

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SOFTWARE FEATURES

This section describes the features and the assumptions made in the following routines:

- o   DISK 1   ROM / BOOT
- o   DISK 1   LOADER
- o   DISK 1   CBIOS
- o   DISK 1   FORMAT
- o   COPY Program
- o   SYSGEN88 / SYSGEN86 Program

The above programs assure a disk which has been formatted by the DISK 1 FORMAT utility. The DISK 1 FORMAT utility always formats side 0 cylinder 0 in 128 bytes sectors, FM, 26 sectors per track. The rest of the disk is formatted in one of the following optional formats:

- o   128 byte sectors, FM, 26 sectors per track.
- o   256 byte sectors, MFM, 26 sectors per track.
- o   512 byte sectors, MFM, 15 sectors per track.
- o 1024 byte sectors, MFM, 8 sectors per track.

Also note that due to the size of the DISK 1 CBIOS; a CP/M System disk must be recorded in one of the MFM modes.

CompuPro DISK 1 ROM/BOOT

The CompuPro DISK 1 ROM code must reside within 256 bytes and contain no memory data references. The ROM code is therefore straight line code performing the following functions:

- o   Put a jump at the 8086 reset location to the ROM code.
- o   Reads the first four sectors (BOOT program).
- o   Disables the ROM.
- o   Begin executing the BOOT program.

The ROM provided on CompuPro DISK 1 revision "E" and later, contain two "jumper selectable" versions of the DISK 1 ROM boot. The "A" half of the ROM contains 8080 code for bringing up CP/M 2.2 or CP/M-86 with the CPU 8085/88 dual processor. The "B" half of the ROM contains 8086 code for use with the CPU 86/87 coprocessor. The "B" half of the ROM will first swap processors so that it can be used with the CPU 8085/88.

Another feature of the "B" half of the ROM is that it can "capture" the 8086 on a reset. When the 8086 is issued a reset signal, it begins to execute code at location OFFFFOh. This means that there must be some code up at the top of the memory map, either in RAM or ROM, for the processor to execute and jump back to the bottom of memory, where the system usually resides. The CompuPro DISK 1 will disable all system memory, so that the processor sees the ROM BOOT in every 256 byte block. By putting a jump to location 0 at OFOh

of the ROM code, the processor will see the jump to 0 at location
0FFFF0h, jump to location 0 and begin executing the ROM code. The
ROM on the SELECTOR CHANNEL - hard disk controller set works the
same way.

The BOOT program resides in the first four sectors of the disk (512
bytes). It is read by the ROM code into location 0100h and
performs the following functions:

    o Reads in the CP/M-86 LOADER.
    o Swaps processors if using a CPU 8085/88.
    o Jumps to the Cold Start entry of the LOADER.

The LOADER resides in the 5th thru 26th sectors of the disk. The
code for the ROM and BOOT is very similar and assumes FM disk read
(side 0 head 0 is always FM).

CompuPro DISK 1 LOADER

The CompuPro DISK 1 CP/M-86 LOADER does the system initialization,
displays a sign on message, and performs a cold start which loads
the CPM.SYS file into memory and transfers control to the CCP.

Cold Start

The Cold Start code performs the following functions:

    o Initialize, System Segment Location 3 -- IOBYTE
    o System Segment Location 4 -- Current Flexible disk
    o Initialize the Memory Region Table (MRT)
    o Performs the Warm Boot function.
    o Transfers control to CCP

CompuPro DISK 1 CBIOS

The CompuPro DISK 1 CP/M CBIOS implements all of the jump vectors
described in the CP/M-86 Operating System System Guide.

Since the CompuPro CBIOS uses Blocker / Deblocker code to handle
the MFM recorded disks; assumptions are required because CP/M 2.2
does not inform the CBIOS when to flush the disk buffer. Floppy
disks are removable media and before a disk can be safely removed
the disk buffer must be flushed. <u>Before</u> a change of disk is
performed one of the following sequences <u>must</u> be performed:

    1. A warm start.
    2. Closing all files and a disk reset.
    3. Call the CBIOS HOME routine.

Failure to perform one of the above sequences might result in disk
data being written on the newly inserted disk.

Warm Boot

The Warm Boot code loads the CP/M CCP and BDOS modules and transfer control to the CCP.

Unit Record

The Standard Unit Record Input / Output routines are:

Console Status.   List Output.
Console Input.   List Status.
Console Output.   Punch Output.
                               Reader Input.

The code included in the CompuPro DISK 1 CBIOS assumes the purchaser has a CompuPro INTERFACER 1,2,3,4 or SYSTEM SUPPORT 1. The Console, reader, punch, and list port assignments are shown in the table below:

INTERFACER 1 or 2:   Console -- ports 0 & 1
                          List -- ports 2 & 3
                          Reader,Punch -- ports 2 & 3
                          UL1 -- not supported

SYSTEM SUPPORT 1:   Console -- ports 05CH & 05DH
                          List -- port 10, user 4
                          Reader,Punch -- not supported
                          UL1 -- port 10, user 5

INTERFACER 3 or 4:   Console -- port 10, user 7
                          List -- port 10, user 4
                          Reader,Punch -- not supported
                          UL1 -- port 10, user 5

Other serial Input/Output controllers are quite similar and usually require very little modification however, parallel or memory mapped video is a different subject and extensive modification might be required.

Home

The HOME routine flushes the BLOCKER / DEBLOCKER buffer and sets the selected track to zero (0).

Select Disk

The Select Disk routine performs the following functions:

o   Checks for valid drive selection.
o   Computes the specified drive's DPH address.
o   If this is a "first time call" then
    the disk type is determined.

Set Track

Sets the selected track to the specified value for a subsequent disk transfer.

Set Sector

Sets the selected sector to the specified value for subsequent disk transfer.

Set Disk Memory Address

Sets the disk memory buffer address for the next disk transfer.

Set Extended Address

This routine allows the user to set the high order byte of the DMA address. This allows the CP/M user to assess the entire memory address range available on the IEEE 696 bus.

Set Number of Sectors

This routine allows the user to access more than one sector on a track at a time. This feature is only useful for individuals who perform direct transfers with the CompuPro CBIOS.

Read from Disk

A 128 byte record is transferred from the disk previously specified by the Select Disk, Set Track, and Set Sector routines, into the memory buffer defined by the Set Disk memory address routine.

Write to Disk

A 128 byte record is transferred from the memory buffer to the previously selected disk track and sector.

Translate Sector Number

A sector translation function is performed on the specified sector using the translation table specified by the caller.

Get Segment Table Address

Returns the address of the system MRT table.

DISK 1 FORMAT

The DISK 1 FORMAT utility has some important features. One of these features is the automatic determination of the number of sides the disk supports. The FORMAT utility will adjust the formatting parameters for a two-sided disk.

Another feature of the DISK 1 FORMAT utility is to perform a read verify which gives the user a check on the ability of the disk to retain data. We have found disks which will have read errors at one density but not a another. If a disk has hard or soft errors at all densities, then this could indicate one of the following problems:

1. Disk media is bad.
2. Drive heads are dirty.
3. Drive is out of adjustment.
4. Controller is out of adjustment.

A third feature of the FORMAT program is its ability to function under CompuPro's MP/M 8-16 and MP/M-86 multi-user systems.

The ability of the FORMAT program to repeat the identical format on another disk saves time when formatting batches of flexible disks.

Features the purchaser might want to add to the DISK 1 FORMAT utility are:

o Formatting System Tracks only.
o Formatting Selected Tracks only.
o Performing "non-destructive" formatting.

COPY Utility

The COPY routine performs a track by track copy of the source disk to the user specified destination disk.

COPY uses the standard CBIOS call formats for reading and writing the data. The only known restriction with this program is that the format of the disk must be compatible with the NEC definition for FM and MFM and the source and destination disks must be exactly the same format and contain the same number of sides.

SYSGEN88 / SYSGEN86 Utilities

The SYSGEN programs will put the BOOT and user specified LOADER file onto the system tracks (0 & 1) of a user specified destination disk.

The BOOT routines are built into the the SYSGEN routines, but the programs will accept any complete LOADER file. The SYSGEN routines will write to either single or double sided disks, and since the

system tracks are always FM, SYSGEN can put the BOOT and LOADER onto a disk formatted in any of the standard MFM formats.

MFORM Utility

The MFORM Utility will format any size CompuPro M-DRIVE/H memory drive. MFORM is invoked automatically at power on, but will not reformat when just the reset button is pressed. So as long as power remains on, the system can be reset without destroying the data on the memory drive.

This section describes the general flow and philosophy of the supplied components.

CompuPro DISK 1 ROM/BOOT

The DISK 1 ROM and BOOT routines are very straightforward. They are both straight line code routines with few loops. The important item to remember when reviewing the listing is the following system disk layout:

Cylinder 0, Head 0 — FM recording; 128 byte sectors 0-3 reserved for CompuPro DISK 1 BOOT. Sectors 5-23 reserved for CompuPro DISK 1 CBIOS. Sector 24 reserved for Group header of LOADER.CMD. Sector 25 reserved for RESTART code loaded at FFF8:0070 (actual location 0FFFF0).

Cylinder 0, Head 1 — MFM recording; 256, 512, or 1024 byte sectors. Sectors 1-n - not used.

Cylinder 1, Head 0 — MFM; 256 byte sectors. Sectors 0-3 reserved for LDCPM. Sectors 4-17 reserved for LDBDOS. Sectors 18-25 reserved.

Cylinder 1, Head 0 — MFM; 512 byte sectors. Sectors 0 -3 reserved for LDCPM. Sectors 4-11 reserved for LDBDOS. Sectors 12-15 reserved.

Cylinder 1, Head 0 — MFM; 1024 byte sectors. Sectors 0-1 reserved for LDCPM. Sectors 2-5,7 reserved for LDBDOS. Sector 6 reserved.

Cylinder 1, Head 1 — MFM; 256, 512, or 1024 byte sectors. Sectors 1-n not used.

The value of ´n´ which equals sectors per track is: 26 for 256 byte sectors, 15 for 512 byte sectors, 8 for 1024 byte sectors.

CompuPro DISK 1 LOADER

The CompuPro DISK 1 LOADER´s basic function is to initialize any hardware that requires it, to load in CP/M and the CBIOS (contained in the file CPM.SYS), and transfer execution to the CCP.

The LOADER.CMD is composed of three parts, LDCPM, LDBDOS, and LDBIOS. LDCPM and LDBDOS are part of CP/M and should never have to be changed. They are included on your system disk as hex files (LDCPM.H86,LDBDOS.H86).

The third part is LDBIOS. This part is very hardware dependent and unique to CompuPro. LDBIOS.H86 is assembled from the CBIOS through

equates and conditional assemblies. LDBIOS uses the same routines
for I/O and disk transfers as the CBIOS, and in addition has its
own USART initialization routines.

CompuPro DISK 1 CBIOS

The CompuPro DISK 1 CBIOS quite literally makes CP/M work. The
CompuPro DISK 1 CBIOS uses a modified version of the CP/M DEBLOCK
routines. The modification stems from the fact that multiple sector
formats are supported. All CP/M disk transfers are 128 bytes in
length, and a method for combining the 128 byte transfers into a
single transfer is required.

The description of tables and variables used in the CompuPro DISK 1
CBIOS are key to its understanding;   therefore the following
paragraphs describe the key tables and variables.

The DPBASE table contains a CP/M Disk Parameter Header (DHP) for
each logical disk drive.   The DPH is described in the CP/M-86
Operating System System Guide, but a few comments here are
appropriate. The PDH is used mostly by CP/M , but four entries are
of interest to the CompuPro DISK 1 CBIOS -- the Translation Table
Address, the Disk Parameter Block (DPB) Address, the Check Vector
Address, and the Allocation Vector Address.   The Check Vector
Address and Allocation Vector Address are mentioned here, because
storage within the CompuPro DISK 1 CBIOS must be reserved for these
CP/M tables.

The Translation Table Address is used to translate CP/M consecutive
sectors into software interlaced external sectors. In order to
maintain compatibility between single density disks, a six sector
interlace table is used; but for other sector formats different
tables are used.

The most important entry within the DPH is the Disk Parameter
Block. This address points to a table -- one table for each disk
type -- which describes the storage characteristics of associated
disk type. The CP/M-86 Operating System System Guide, describes the
entries within the DPB, but the Guide does not describe why the
CompuPro DISK 1 CBIOS has defined the DPB values. The format of
the CompuPro DISK 1 CBIOS DPBs follows:

Disk type definition blocks for each particular mode. The format
of these areas are as follows:

```
         8 bit  =  Disk type code
        16 bit  =  Sectors per track
         8 bit  =  Block shift
         8 bit  =  BS mask
         8 bit  =  Extent mask
        16 bit  =  Disk size/1024 - 1
        16 bit  =  Directory size
        16 bit  =  Allocation for directory
        16 bit  =  Check area size
        16 bit  =  Offset to first track
```

The Sector translation tables contain values which are CP/M compatible or compatible with other popular CP/M implementations.

Now that the description of the tables is complete, the key variables need to be described. The variables contain information about various stages of a disk transfer. The following variables:

    ACTDSK --- Disk Selection Value
    ACTTYP --- Disk Type
    ACTTRK --- Track Number
    ACTSEC --   Sector in Track

The information about the data contained within the host disk deblocking buffer is contained in a corresponding set of variables called HSTDSK, HSTTYP, HSTTRK, and HSTSEC. The SEKxxx variables contain the initial CP/M data transfer request. The variables might result in an actual physical transfer, or the data requested could be contained in the host disk deblocking buffer. Each time CP/M calls the WRITE routine, the C register contains a value which indicates on of the following:

    0 --- Write to a allocated block
    1 --   Write to the directory
    2 --- First write to a previously unallocated block

How the CompuPro DISK 1 CBIOS uses these values and other variables reduces the number of unnecessary pre-reads.

The following paragraphs describe the differences between the CBIOS described in the CP/M-86 Operating System System Guide, and the CompuPro DISK 1 CBIOS implementation. The reader should be especially familiar with Sections 6 and 12.

The SECTRAN routine differs from the Alteration Guide by testing register DE. If register DE is zero, then no sector translation is performed. Otherwise, DE contains the translation table address.

Since the CompuPro DISK 1 CBIOS attempts to detect the density and number of sides of a floppy disk contains, the SELDSK diverges significantly from the Alteration Guide. When the SELDSK is invoked by CP/M, the disk selection value is saved. SELDSK calculates the DPH address, and the least significant of DE is tested for zero. If the bit is non-zero, then the disk type is extracted and saved, and the DPH address is returned.

The more complicated process begins when the bit is zero. The SELDSK routine calls TREAD to try and determine the floppy disk type. If TREAD returns with the zero flag set, then the type was determined. SELDSK then computes the appropriate DPB address and initializes the translation table and DPB address in the DPH.

The READ routine appears simplified, but this is a result of modularizing its code. This routine first calls the CHKBKD routine, which checks the disk type for single density floppy. If

the disk is a single density floppy, then the READ routine jumps to the physical sector reading routine FINAL. if the disk is not a single density floppy, then the host buffer is filled by the FILL routine, and the appropriate 128 byte sector is moved to the user's buffer.

The WRITE routine is significantly more complicated than the READ routine. This complication results from the attempt to reduce the number of unnecessary pre-reads of the disk.

The WRITE routine calls CHKBKD to determine the disk type. If the disk type is a single density floppy, a jump to the physical WRITE routine is performed. If the disk type is not a single density, then the logic parallels the WRITE routine documented in the Alteration Guide.

CompuPro DISK 1 CBIOS is written fairly straightforward, and only two places are "sneaky". The first sneaky portion is in the FILL routine. The FILL routine returns two parameters on the stack: the host buffer address, and the caller's buffer address. The code to place these two addresses into the stack starts with the XTHL instruction. The other "sneaky" code is in SETUP. SETUP pushes the transfer routine address onto the stack so that the EXEC routine jumps directly to the appropriate disk transfer routine.

This concludes the description of the CompuPro DISK 1 CBIOS. If the reader wishes more detailed information, he should refer to the listings and source of the supplied CompuPro DISK 1 CBIOS.

CHANGING SOFTWARE CONTROLLED PARAMETERS

As shipped, CP/M-86 is configured so that the floppy disk drive step rate is 8 msec and all of the programmable USARTS (I/O 3 & 4 and System Support board) are programmed for 8 data bits, 2 stop bits, no parity and 9600 baud. To make changing these parameters easier, we have provided a table that the system will load the values from. By patching this table in the LOADER and CPM.SYS file you can change any of these parameters. You can also change the relative user number of your INTERFACER 3 or 4 so that both your console and printers are on by changing the appropriate relative user numbers in the table. First set up a system disk with the proper configuration of hard and floppy disks and I/O, and bring up this system. The tables can then be patched as below:

```
A>DDT86
DDT86 1.1
-rLOADER.CMD
       START        END
   3E0:0000    3E0:1BFF
-S12C4
3E0:12C4  80  __   (80 for 8 msec,A0 for 6 msec,D0 for
                     3 msec step rate)
3E0:12C5  07  __   (relative user number 7, or
                     SYSTEM SUPPORT 1 - console)
3E0:12C6  EE  __   (mode register 1)
3E0:12C7  7E  __   (mode register 2,baud rate:7E=9600,7F=19.2k)
3E0:12C8  27  __   (command register)
3E0:12C9  04  __   (relative user number 4 - list device)
3E0:12CA  EE  __   (mode register 1)
3E0:12CB  7E  __   (mode register 2)
3E0:12CC  27  __   (command register)
3E0:12CD  05  __   (relative user number 5 - UL1 device)
3E0:12CE  EE  __   (mode register 1)
3E0:12CF  7E  __   (mode register 2)
3E0:12D0  27  __   (command register)
3E0:12D1  00  .
-wLOADER.CMD
-^C
A>SYSGEN88 LOADER.CMD
COPYSYS Version 2.2P
Destination drive name (or RETURN to terminate)A
Destination on A, then type return.
Function complete.
Destination drive name (or RETURN to terminate)

A>
```

Fill in the lines as desired. (See the interfacer manuals for a full description of the mode and command registers of the USARTs.) This will put a new loader on the "A" drive. Now make the same changes that you made to the loader to the table in your CPM.SYS file as below:

```
A>DDT86
DDT86 1.1
-rCPM.SYS
   START     END
 3E0:0000  3E0:2FFF
-s25C4              (start of table)
3E0:25C4   80 __    (80 for 8 msec,A0 for 6 msec,D0 for 3 msec
                     step rate)
3E0:25C5   07 __    (relative user number 7, or SYSTEM SUPPORT 1
                     - console)
3E0:25C6   EE __    (mode register 1)
3E0:25C7   7E __    (mode register 2,baud rate:7E=9600,7F=19.2k)
3E0:25C8   27 __    (command register)
3E0:25C9   04 __    (relative user number 4 - list device)
3E0:25CA   EE __    (mode register 1)
3E0:25CB   7E __    (mode register 2)
3E0:25CC   27 __    (command register)
3E0:25CD   05 __    (relative user number 5 - UL1 device)
3E0:25CE   EE __    (mode register 1)
3E0:25CF   7E __    (mode register 2)
3E0:25D0   27 __    (command register)
3E0:25D1   00 .  .
-wCPM.SYS
-^C
A>
```

Now reboot your system and you will be running with the new
parameters.

REASSEMBLING THE CP/M-86 SYSTEM

To reassemble the CP/M-86 system (which consists of the loader and the CPM.SYS file), you will need the following:

1. A working system.
2. A copy of ACT-86 from Sorcim. *
3. A working version of CP/M 80 with utilities.

The CP/M-86 system consists of two parts - the LOADER BIOS and the actual SYSTEM BIOS. These two BIOS´ are assembled out of the same set of source files that are on your system diskette. Conditional assembly statements within the files select which BIOS is built at assembly time. Two submit files (MAKLDR.SUB and MAKSYS.SUB) have been provided to aid the re-assembly process. They will run on a CP/M 80 system, with the CP/M-86 disk in the "B" drive.

```
;maksys.sub
;make a CPM.SYS file
ACT86 B:GBCBIOS.a86 o=40h h=CBIOS.h86
PIP CPMX.H86=b:CPM.h86,b:CBIOS.h86
b:Gencmd CPMX 8080 code[a41]
pip b:SYS.sys=CPMX.cmd

;makldr.sub
;make LOADER BIOS
ACT86 b:GBCBIOS.a86 o=4020h h=LDBIOS.h86
pip LOADER.h86=b:LDCPM.h86,b:LDBDOS.h86,b:LDBIOS.h86
GENCMD LOADER 8080 code[A400]

;copysys LOADER.CMD
```

The MAKSYS file will assemble the BIOS and store it in a file called CPMX.CMD on the A drive. We have noticed that GENCMD.COM sometimes creates files of erroneous length. It is recommended that you load the CPMX.CMD file with DDT and SAVE it with the correct number of records before turning it into the CPM.SYS file. Otherwise the loader will try and load in a much larger CPM.SYS file and could overlay the loader causing the system to bomb. You will have to determine the correct number of records to save from your assembly listing.

Note that reassembly should only be attempted by the most experienced programmers. Expect no hand-holding from CompuPro, G & G Engineering or Sorcim. It should normally not be necessary to reassemble the BIOS since the system will self size and we have given you almost every possible configuration and you can patch the baud rates as above.

---

* ACT-86 can be obtained for $175.00 from: SORCIM
405 Aldo Ave.
Santa Clara, CA   95050
(408) 727-7634

or probably from your local computer dealer.

HARDWARE SECTION
TROUBLESHOOTING YOUR SYSTEM

The following table has been designed to aid you in the event your system does not operate correctly:

Problem	Probable Cause	Remedy
	FLOPPY DISK	
Fan off, power indicator not lit:	Power cord not plugged in.	Plug in cord.
	Power cord not plugged into rear panel of system.	Plug in cord.
	Wall outlet not live.	Check outlet. Check circuit breaker.
	Main circuit breaker has tripped.	Check system for shorts; turn breaker OFF, then back ON.
Fan on, power Indicator not lit	Indicator light bad.	Replace indicator light.
	Internal connection loose.	Contact dealer.
	Power supply connection loose.	Contact dealer.
Power on, but disk drive indicator light does not blink:	Disk drive not plugged in.	Plug it in.
	Power cord not plugged in.	Plug it in.
	Floppy disk drive breaker switch not ON.	Turn it ON.
	Circuit breaker on disk drive rear panel tripped.	Check connections for shorts; turn breaker OFF, then back ON.

Problem	Probable Cause	Remedy
Disk drive indicator light does not blink	Cable improperly connected.	Re-connect it.
	System not initialized.	Push RESET on Enclosure 2 front panel.
Drive head loads, seeks, but system does not power up:	Floppy diskette inserted incorrectly.	Insert diskette with label facing up and away from slot.
	Incorrect diskette inserted.	Insert MP/M boot diskette.
	Cables and plugs incorrectly connected	Refer to board manuals.
	HARD DISK	
Drive does not initialize	Data or control cable connected incorrectly.	Methodically change cable connections.
	Power supply connection loose.	Contact dealer.
	Drive head not unlocked.	Unlock head.
	CPU switch settings incorrect.	Reset switches.
	Internal drive cable unplugged.	Check cable connections.
	Internal drive cable disconnected.	Undo cover of drive cabinet and and re-connect.
	Error in tracks tracks 0 and 1.	Contact dealer.

Problem	Probable Cause	Remedy
	TERMINAL I/O	
System sounds like it booted up but no message on the terminal	Cable incorrectly connected.	Check cable connections.
	Terminal incorrectly set.	Check baud rate and word size settings.
	Terminal not powered up.	Plug in terminal and turn on.
	I/O board switches not set properly.	Reset switches.
	I/O board headers not wired correctly.	Recheck connections on headers.
	Bad RS232 cable.	Try another cable.

HARDWARE SETTINGS FOR MP/M 8-16

CPU 8085/88 — Switch Settings:

```
        S1                    S2                    S3
   OFF     ON            OFF     ON            OFF     ON
  |    ==| 1           |==    | 1           |==    | 1
  |    ==| 2           |==    | 2           |    ==| 2
  |    ==| 3           |==    | 3           |==    | 3
  |==    | 4           |==    | 4           |==    | 4
  |==    | 5           |==    | 5           |==    | 5
  |==    | 6           |==    | 6           |==    | 6
  |    ==| 7           |==    | 7           |==    | 7
  |==    | 8           |==    | 8           |==    | 8
  |      |             |      |             |      |
```

CPU 86/87 — Switch Settings:

```
     S1            S2            S3            S4            S5
 OFF    ON     OFF    ON     OFF    ON     OFF    ON     OFF    ON
|==    | 1   |==    | 1   |==    | 1   |==    | 1   |==    | 1
|==    | 2   |==    | 2   |==    | 2   |==    | 2   |==    | 2
|==    | 3   |==    | 3   |    ==| 3   |    ==| 3   |==    | 3
|==    | 4   |==    | 4   |    ==| 4   |    ==| 4   |==    | 4
|==    | 5   |==    | 5   |==    | 5   |    ==| 5   |==    | 5
|==    | 6   |==    | 6   |==    | 6   |    ==| 6   |==    | 6
|==    | 7   |==    | 7   |    ==| 7   |    ==| 7   |==    | 7
|==    | 8   |==    | 8   |==    | 8   |    ==| 8   |==    | 8
|==    | 9   |==    | 9   |      |     |    ==| 9   |==    | 9
|==    | 10  |==    | 10  |      |     |    ==| 10  |==    | 10
|      |     |      |                 |      |     |      |
```

Jumpered Settings: J8 -- No shunt installed if using an 8087
                     coprocessor, otherwise install shunt.

SYSTEM SUPPORT 1 — Switch Settings:

```
        S1                    S2                    S3
   OFF     ON            OFF     ON            OFF     ON
  |==    | 1           |    ==| 1           |==    | 1
  |==    | 2           |    ==| 2           |==    | 2
  |==    | 3           |    ==| 3           |==    | 3
  |    ==| 4           |    ==| 4           |==    | 4
  |==    | 5           |==    | 5           |    ==| 5
  |==    | 6           |==    | 6           |==    | 6
  |    ==| 7           |==    | 7           |    ==| 7
  |==    | 8           |==    | 8           |==    | 8
  |      |             |      |             |      |
```

Jumpered Settings:

  J1 — Serial port connection.

  J2 — Insert an eight pin dip shunt, leaving the lower five
       pins on the right side out. Leaving the first three
       wires shunted effectively makes a 3-wire serial monitor
       connection with handshaking.

  J3 — Plug an auxiliary battery cable into this connector, red
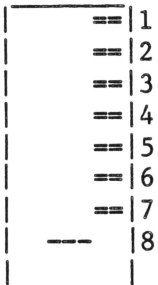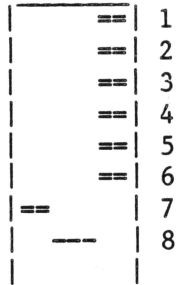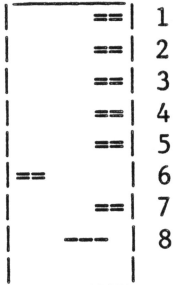   wire toward the left.

  J13 — Insert a shorting plug onto prongs 8 and C.
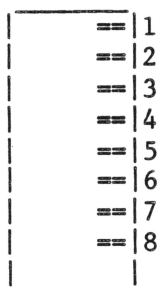
  Remaining jumpers are left unconnected.
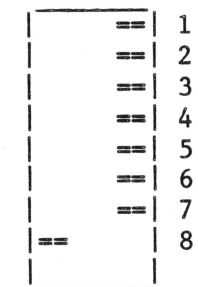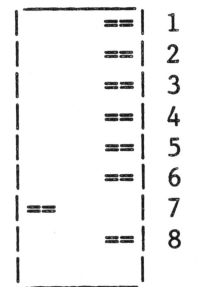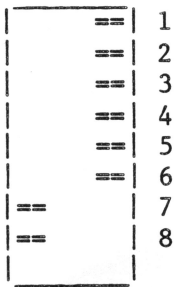
Rom Sockets:

  U16 — Install a "GO 86" EPROM (if you have a CPU 8085/88)

RAM 21 MEMORY BOARD - Switch Settings for S1:

```
1st 128K        2nd 128K        3rd 128K        4th 128K
OFF   ON        OFF   ON        OFF   ON        OFF   ON

|    ==|1       |    ==| 1      |    ==| 1      |    ==| 1
|    ==|2       |    ==| 2      |    ==| 2      |    ==| 2
|    ==|3       |    ==| 3      |    ==| 3      |    ==| 3
|    ==|4       |    ==| 4      |    ==| 4      |    ==| 4
|    ==|5       |    ==| 5      |    ==| 5      |    ==| 5
|    ==|6       |    ==| 6      |==    | 6      |==    | 6
|    ==|7       |==    | 7      |    ==| 7      |==    | 7
|    ---|8      |    ---| 8     |    ---| 8     |    ---| 8
|      |        |      |        |      |        |      |
0-1FFFF         20000-3FFFF     40000-5FFFF     60000-7FFFF
```


RAM 16 MEMORY BOARD - Switch Setting for S1:

```
1st 64K         2nd 64K         3rd 64K         4th 64K
OFF   ON        OFF   ON        OFF   ON        OFF   ON

|    ==|1       |    ==| 1      |    ==| 1      |    ==| 1
|    ==|2       |    ==| 2      |    ==| 2      |    ==| 2
|    ==|3       |    ==| 3      |    ==| 3      |    ==| 3
|    ==|4       |    ==| 4      |    ==| 4      |    ==| 4
|    ==|5       |    ==| 5      |    ==| 5      |    ==| 5
|    ==|6       |    ==| 6      |    ==| 6      |    ==| 6
|    ==|7       |    ==| 7      |==    | 7      |==    | 7
|    ==|8       |==    | 8      |    ==| 8      |==    | 8
|      |        |      |        |      |        |      |
0-FFFF          10000-1FFFF     20000-2FFFF     30000-3FFFF
```

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RAM 17 MEMORY BOARD   - Switch Settings for S1:

```
              OFF   ON
            |==      | 1
            |     ==| 2
            |     ==| 3
            |     ==| 4
            |     ==| 5
            |     ==| 6
            |     ==| 7
            |     ==| 8
            |     ==| 9
            |     ==| 10
            |       |
```

Switch Settings for S2:

```
  1st 64k          2nd 64k          3rd 64k          4th 64k
  OFF   ON         OFF   ON         OFF   ON         OFF   ON

|==      | 1     |==      | 1     |==      | 1     |==      | 1
|     ==| 2      |     ==| 2      |     ==| 2      |     ==| 2
|     ==| 3      |     ==| 3      |     ==| 3      |     ==| 3
|     ==| 4      |     ==| 4      |     ==| 4      |     ==| 4
|     ==| 5      |     ==| 5      |     ==| 5      |     ==| 5
|     ==| 6      |     ==| 6      |     ==| 6      |     ==| 6
|     ==| 7      |     ==| 7      |     ==| 7      |     ==| 7
|     ==| 8      |     ==| 8      |==      | 8      |==      | 8
|     ==| 9      |==      | 9     |     ==| 9      |==      | 9
|     ==| 10     |     ==| 10     |     ==| 10     |     ==| 10
|       |        |       |        |       |        |       |
 0-FFFF          10000-1FFFF      20000-2FFFF      30000-3FFFF
```

DISK 1 FLOPPY DISK CONTROLLER   -   Switch Settings:

```
        S1                      S2
     OFF  ON                 OFF  ON

    |    ==| 1              |    ==| 1*
    |==    | 2              |    ==| 2*
    |==    | 3              |==    | 3
    |==    | 4~             |==    | 4
    |==    | 5              |    ==| 5
    |==    | 6              |    ==| 6
    |==    | 7              |    ==| 7
    |==    | 8              |    ==| 8
    |      |                |      |
```

~   OFF to BOOT from a Floppy Disk,   ON to BOOT from a Hard Disk.

*   Paddles 1 & 2 ON for INTERFACER 1 & 2;   Paddle 1 OFF, Paddle 2 ON for SYSTEM SUPPORT 1;   Paddle 1 & 2 OFF for INTERFACER 3 & 4

- Jumpered Settings: J16 -- Install a jumper on B-C

                        J17 -- Jumper A-C if using a CPU 8085/88
                               Jumper B-C if using a CPU 86/87

DISK 2/SELECTOR CHANNEL HARD DISK CONTROLLER

DISK 2 Switch settings:

```
                    S1                  S2
                 OFF   ON            OFF   ON

                |==      |  1       |==      |  1
                |==      |  2       |==      |  2
                |     == |  3       |     == |  3
                |==      |  4       |     == |  4
                |     == |  5       |==      |  5
                |==      |  6       |     == |  6
                |     == |  7       |     == |  7
                |==      |  8       |     == |  8
                |==      |  9       |_____|
                |==      | 10
                |_____|
```

SELECTOR CHANNEL   Switch settings:

```
                                   S1
                                OFF   ON

                               |==      |  1~
                               |     == |  2
                               |==      |  3
                               |==      |  4
                               |==      |  5
                               |==      |  6
                               |     == |  7
                               |     == |  8
                               |     == |  9
                               |     == | 10
                               |_____|
```

~ OFF to BOOT from Floppy Disk; On to BOOT from Hard Disk

Jumper settings:

    J8   Jumper installed on "+" if INTERFACER 3 or INTERFACER 4
           Jumper installed on "G" if SYSTEM SUPPORT 1 or INTERFACER 1

    J9   Jumper installed on "+" if INTERFACER 3, INTERFACER 4, or
              SYSTEM SUPPORT 1
           Jumper installed on "G" if INTERFACER 1

    J10   Jumper installed on "G" if CPU 8085/88
           Jumper installed on "+" if CPU 86/87

DISK 3 Switch Settings:

```
        S1                    S2
     OFF   ON             OFF   ON
    |_____|         |_____|
    | ==      | 1        | ==      | 1
    |      == | 2        |      == | 2
    |      == | 3        |      == | 3
    | ==      | 4        | ==      | 4
    |      == | 5        |    ---  | 5
    |      == | 6        |    ---  | 6
    |      == | 7        |    ---  | 7
    |    ---  | 8        |    ---  | 8
    |         |          |         |
    |_____|          |_____|
```

Jumper Settings:

J1	Connector for drive 1 radial cable.
J2	Connector for drive 2 radial cable.
J3	Connector for drive 3 radial cable.
J4	Connector for drive 4 radial cable.
J5	Connector for daisy chained cable cable for all drives.
J6	(Not currently used.)
J7	B-C
J8	A-C
J9	Jumper position 1.
J10	Jumper top position.

INTERFACER 1

S1 — Set paddles according to baud rate settings described in Technical Manual (example is for 9600 baud).

```
        S1                    S2                    S3
     OFF   ON             OFF   ON             OFF   ON
    |_____|         |_____|         |_____|
    |      == | 1        |      == | 1        | ==      | 1
    | ==      | 2        |      == | 2        |      == | 2
    | ==      | 3        |      == | 3        |      == | 3
    | ==      | 4        |      == | 4        |      == | 4
    |      == | 5        |      == | 5        |      == | 5
    | ==      | 6        |      == | 6        |      == | 6
    | ==      | 7        |      == | 7        |      == | 7
    | ==      | 8        | ==      | 8        | ==      | 8
    |         |          |         |          |         |
    |_____|          |_____|          |_____|
```
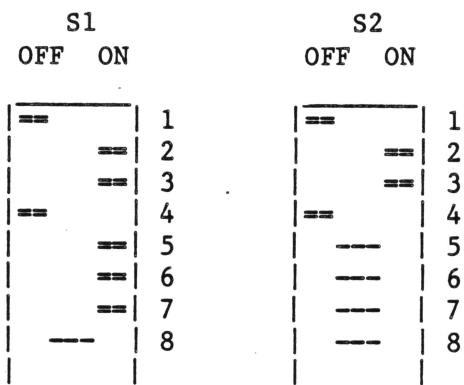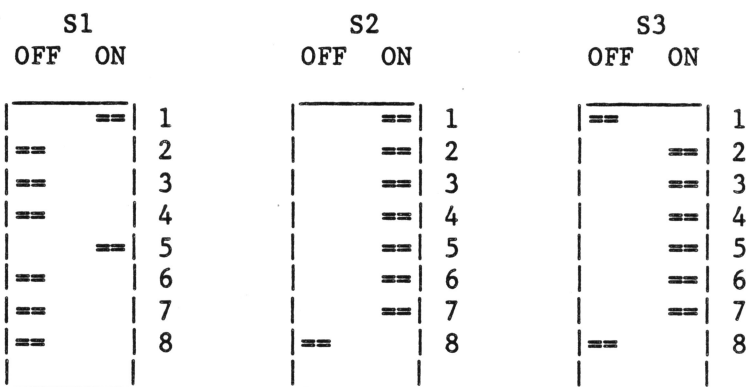
Jumpered Settings: J3 & J5 — Pin 1 to 15
                              Pin 2 to 16

                    J4 & J6 — Pin 6 to 7

INTERFACER 3 - Switch Settings for S1:

```
        OFF   ON
       |==        |  1
       |       == |  2
       |       == |  3
       |       == |  4
       |==        |  5
       |       == |  6
       |       == |  7
       |       == |  8
       |_____|
```

Jumpered Settings:

   J1 -- Insert a dip shunt, shunting lines 1, 2 and 3 for 3-
        wire, no handshaking. Consult manual for hardware
        handshaking.

   J2 -- Insert a dip shunt, shunting lines 1, 2 and 3 for 3-
        wire, no handshaking. Consult manual for hardware
        handshaking.

   J17 -- Jumper top two pins.

   Remaining jumpers unconnected.

INTERFACER 4: - Switch Settings:

```
        S1                 S2                 S3
     OFF   ON           OFF   ON           OFF   ON
    |==       |  1     |      ==|  1      |      ==|  1
    |==       |  2     |      ==|  2      |      ==|  2
    |==       |  3     |==      |  3      |      ==|  3
    |==       |  4     |==      |  4      |      ==|  4
    |==       |  5     |      ==|  5      |==      |  5
    |==       |  6     |      ==|  6      |==      |  6
    |==       |  7     |      ==|  7      |==      |  7
    |==       |  8     |==      |  8      |==      |  8
    |==       |  9     |      ==|  9      |_____|
    |==       | 10     |      ==| 10
    |_____|         |_____|
```

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- Jumpered Settings

      J1 — No Shunt need be installed

      J2 — Bottom installed with Microline 80 printer /
           No shunt otherwise

      J3 — Top installed with Microline 80 printer /
           No shunt otherwise

      J4 — Bottom installed with both Microline 80 and Centronics

  J5-J25 — Removed

      J26 — Jumper A-B and C-D for the CENTRONICS CHANNEL as user 4.
           Jumper A-C and B-D for the CENTRONICS CHANNEL as user 6.

JS1,JS2,JS3 — Install shunt, shorting all 8 lines.

  JS4-JS6 — No connections.

M-DRIVE/H - Switch settings

S1 OFF ON		Board Number	Switch Number* 8	9	10
==	1	1st . . . . ON	ON	ON	
==	2	2nd . . . . ON	ON	OFF	
==	3	3rd . . . . ON	OFF	ON	
==	4	4th . . . . ON	OFF	OFF	
==	5	5th . . . . OFF	ON	ON	
==	6	6th . . . . OFF	ON	OFF	
==	7	7th . . . . OFF	OFF	ON	
==	8	8th . . . . OFF	OFF	OFF	
==	9				
==	10				

*Switches 1 thru 7 are the set
the same on all boards.

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IF YOU NEED ASSISTANCE ALWAYS CONTACT YOUR COMPUPRO SYSTEM CENTER/DEALER FIRST

CompuPro products are available Assembled/Tested with a 1 year limited warranty, or qualified under the Certified System Component (CSC) high-reliability program (200 hour burn-in, 2-year limited warranty, and direct exchange program for the boards in the event of malfunction).

Our paramount concern is that you are satisfied with any CompuPro product, so please follow the procedures below to help us serve you better.

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COMPUPRO — RMA #_____
3339 ARDEN ROAD
HAYWARD, CA 94545.

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